Badlands National Park

Pennington, Jackson, and Shannon Counties, South Dakota

Swift Fox Reintroduction Environmental Assessment

June 3, 2003

Recommended:

_____ _____

Wildlife Biologist Date

Concurred:

_____ _____

Chief of Resource Management Date

Approved:

_____ _____

Superintendent Date

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I. INTRODUCTION

A. Park History and Purpose

Badlands National Park is located in southwestern South Dakota, approximately 70 miles east of Rapid City. The park consists of three units totaling approximately 244,000 acres. The North Unit, which is the best known and most accessible, includes the 64,144 acre Badlands Wilderness Area. The Stronghold and Palmer Creek Units are located within the Pine Ridge Indian Reservation and are managed by the National Park Service under a Memorandum of Agreement with the Oglala Sioux Tribe.

Badlands National Monument was originally authorized by the US Congress in 1929, and established by Presidential proclamation in 1939 after certain requirements were met by the State of South Dakota. The original Monument boundaries are generally referred to as the North Unit. In 1968, a portion of the former Badlands Bombing Range, located within Pine Ridge Indian Reservation, was added to the National Monument by public law and became known as the Stronghold and Palmer Creek Units. In 1976, public law designated the 64,144-acre Badlands Wilderness Area. Badlands National Monument was re-designated Badlands National Park by Congressional Act in 1978.

Throughout this 73 year history, the purposes of Badlands National Park have continued to evolve, generally around the themes of fossils, geology, prairie, and people. Based on park legislation and legislative history, the purpose of Badlands National Park (as identified in park strategic planning) is to:

- Protect the unique landforms and scenery of the White River Badlands for the benefit, education and inspiration of the public.
- Preserve, interpret, and provide for scientific research, the paleontological and geological resources of the White River Badlands.
- Preserve the flora, fauna and natural processes of the mixed grass prairie ecosystem.
- Preserve the Badlands Wilderness Area and associated wilderness values.
- Interpret the history of the Lakota Nation

B. Proposed Action

Under provisions of the National Environmental Policy Act (NEPA), the Resource Management Division at Badlands National Park proposes the reintroduction of native swift fox (*Vulpes velox*) into Badlands National Park of southwestern South Dakota, during 2003 through 2005, with the goal of establishing a self-sustaining wild population.

C. Purpose and Need

Background: The swift fox (*Vulpes velox*) is an important species of the shortgrass and mixed grass prairies of the Great Plains of North America. Historically, this very small (5 pounds) fox occurred in all or portions of North Dakota, South Dakota, Montana, Nebraska, Wyoming, Colorado, Kansas, Oklahoma, New Mexico, and Texas, and the southern prairie region of Alberta, Manitoba, and Saskatchewan (Hall 1981, Hall and Kelson 1959, Samual and Nelson 1982, Scott-Brown et al. 1987, Sovada and Scheick 1999). Habitat components include loose soils for easy burrowing and low grass or

shrub ground cover to allow distant viewing. These opportunistic foragers cover long distances in search of jackrabbits, cottontails, prairie dogs, ground squirrels, mice, insects, birds and carrion. Predators to swift fox include badgers, bobcats, coyotes, red fox, and golden eagles. Swift foxes were once abundant throughout much of their range until the late 1800s to the early 1900s. Records from the American Fur Company, report trading of over 10,000 swift fox pelts between 1835 and 1838 at the American Fur Company's Upper Missouri Outfit (near the confluence of the Big Sioux and Missouri rivers [SE South Dakota]; Johnson 1969) and the Hudson's Bay Company traded over 100,000 pelts between 1853 and 1877 (Rand 1948).

With European settlement of the plains, swift fox populations declined dramatically by the late 1800s (Zumbaugh and Choate 1985). The decline can be attributed to factors including conversion of native prairie to agriculture and the associated declines in prey species (Egoscue 1979), unregulated hunting and trapping, rodent control programs, and predator control programs aimed at larger carnivores (Carbyn et al. 1994, FaunaWest 1991, Kilgore 1969, Samuel and Nelson 1982). The historical change in the canid community of the Great Plains from a wolf-dominated hierarchy to a coyote-dominated system may have also caused declines in swift fox populations due to interspecific competition between swift fox and coyotes (Higgins et al. 2002). Perhaps the most important direct cause of swift fox population decline was inadvertent poisoning from strychnine-laced bait targeted at wolves (*Canis lupus*) and sodium monofluoracetate (compound 1080) bait stations (Robinson 1953, Scott-Brown et al. 1987, Young 1944). Swift foxes readily accepted poisoned baits and thus died by the thousands (Bailey 1926, Young 1944). Swift foxes declines were greatest in their northern range, being extirpated from Canada and North Dakota (Soper 1964, Sovada and Scheick 1999) and remaining in scattered, remnant populations in South Dakota, Nebraska, and Montana.

The present contiguous range of the swift fox extends from Wyoming south through eastern Colorado, western Kansas, eastern New Mexico, Oklahoma panhandle and extreme northern Texas. Small, fragmented populations exist in South Dakota and Nebraska (Swift Fox Conservation Team 2000). An isolated, but expanding, population exists in southern Canada and northern Montana as a result of the Canadian swift fox release program and more recently a reintroduction by Defenders of Wildlife and the Blackfoot Nation on the Blackfoot Reservation (Giddings 1998). The only significant northern expansion of the swift fox distribution has occurred because of reintroduction programs (Carbyn 1998). Carbyn et al. (1994) hypothesized that three factors may be limiting northern expansion of swift fox. First, swift foxes may move north, become established, and then die out. Second, swift fox may be poor dispersers. Third, physical barriers (extensive breaks on river systems) may be preventing expansion. Swift foxes are expanding in Canada, so the habitat niche for swift fox was still present and swift fox are likely to expand once they are reintroduced (L. Carbyn per. comm.).

South Dakota's only population of swift fox occurs in the extreme southwestern corner of the state (Kruse et al 1995; Dateo et al 1996). This population is at high risk due to prairie dog poisoning, land uses (agriculture), and other causes. Thus, it has been unable to expand north and east to reach the protected areas of Badlands National Park and the surrounding national grassland, even though there is extensive suitable habitat on these federal lands.

Swift foxes are part of the heritage of Badlands, and likely were common prior to the early 1900s. There have been recent occupations of swift foxes in Badlands. In 1987 and 1988, a swift fox family (male, female and kits) was relocated to Badlands from the Pine Ridge Indian Reservation because the prairie dog town adjacent to the natal den was being poisoned. Following those releases, swift fox sightings continued in Badlands for a few years. However, since a resident population had not existed in Badlands and no further releases were conducted, foxes could not establish a self-sustaining population. No systematic surveys specifically for swift foxes have been conducted in Badlands, but more than 600 hours of annual spotlight surveys associated with black-footed ferret (*Mustela nigripes*) population monitoring yielded no swift fox sightings.

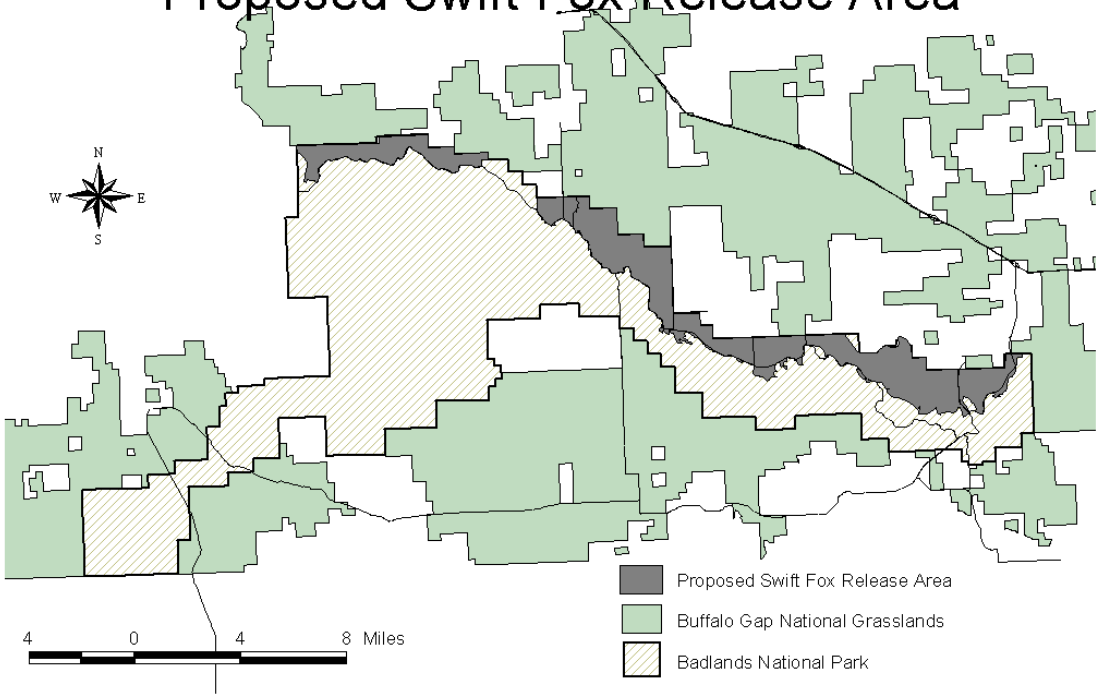
South Dakota lists the swift fox as threatened (South Dakota Codified law 34A-8) and is therefore mandated to "manage, protect, and restore" the species. The NPS *Management Policies* (2001) state in Section 4.4.2.2 "the Service will strive to restore extirpated native plant and animal species to parks . . ". Of the 24 NPS units located within the historic range of swift fox, 14 have the potential for the presence of swift fox; however, there are no recent records of swift fox at any of these units. Furthermore, "Badlands National Park appears to have the best potential for supporting a self-sustaining population" of swift foxes in existing NPS lands (Licht 2000). The U.S. Fish and Wildlife Service (USFWS) identified swift foxes as an "umbrella species", and as such, if land managers maintain habitat and other conditions that enhance swift fox populations, this serves as an umbrella of protection for many other threatened native prairie species.

Continued concern for the future welfare of this species is indicated by a written reaffirmation (Swift Fox Conservation Team 2000) of commitment to implement a Conservation Strategy Plan by Directors of State and Federal Agencies represented on the Swift Fox Conservation Team. This team was established in response to the "warranted but precluded" 90-day finding of the US Fish and Wildlife Service in 1994. The team includes members from the 10 affected state wildlife management agencies and interested cooperators (several Federal agencies, including the National Park Service, US Geologic Survey, US Fish and Wildlife Service, Bureau of Land Management, US Forest Service; and the Canadian Wildlife Service). The Swift Fox Conservation Team developed a Conservation Assessment and Conservation Strategy document for the swift fox intended to provide the framework to direct swift fox conservation as an alternative to a federally mandated recovery effort. This document includes restoring swift fox to "50 percent of the suitable habitat that is available"…"through wild-captured swift fox introductions". This strategy goal is a priority in states, such as South Dakota, that do not have a swift fox population or have a severely limited distribution. In response to the development of this Conservation Strategy, and the accumulation of more specific range wide population estimates of the swift fox, the US Fish and Wildlife Service determined in January, 2001 that the swift fox did not warrant federal listing under the Endangered Species Act.

During the 2001 annual meeting of the Swift Fox Conservation Team, held in Rapid City, SD on October 17-18, a field trip was taken by team members to visit the Badlands National Park area for the purpose of evaluating the potential habitat for swift fox reintroductions. The group consensus was that the upper prairie of the park located north of Hwy. 240 in the North Unit of the park possessed excellent potential swift fox habitat. This area of rolling grasslands within the park encompasses approximately

18,800 acres of habitat is proposed as the release area for swift fox (See **Figure 1** below).

Figure 1. Badlands National Park
Proposed Swift Fox Release Area



Highway 240 lies along the top edge of a badlands ridge and is the southern most boundary of a topographic prairie shelf that extends to the north. Adjacent to the north of the park, and also part of this rolling grassland prairie, is an additional 61,000+ acres of U.S. Forest Service - Buffalo Gap National Grassland that also provide suitable habitat for swift fox.

In September 2002, Turner Endangered Species Fund began swift fox reintroductions on their Bad River Ranches property approximately 60 miles northeast of Badlands National Park along the Bad River drainage. The Turner Endangered Species Fund is a private non-profit charity dedicated to conserving biodiversity by ensuring the persistence of imperiled species and their habitats. Cooperative swift fox recovery efforts between Turner Endangered Species Fund and Badlands National Park would contribute to an expansive restoration area in western South Dakota.

Purpose: The immediate purpose of the proposed action is to use established, as well as experimental, techniques to reintroduce and establish a free-ranging wild population of swift fox into the mixed-grass prairie of South Dakota.

Need: The swift fox is a native grasslands species that has declined in recent years in the northern parts of its range, notably in western South Dakota. The species is currently listed as a Threatened Species by the state of South Dakota. National Park Service *Management Policies* (2001) states in Section 4.4.2.3, “The National Park

Service will inventory, monitor, and manage state and locally listed species in a manner similar to its treatment of federally listed species, to the greatest extent possible". The NPS is obligated under the Endangered Species Act of 1973, as amended, in Section 2(c) to take action to recover threatened and endangered species. Specifically, "It . . . is the policy of Congress that all federal departments and agencies shall seek to conserve endangered and threatened species . . .", and in Section 3(3) "to use . . . all methods and procedures which are necessary to bring any endangered or threatened species to the point at which the measures provided in this Act are no longer necessary". Badlands National Park is currently in the process of establishing a new General Management Plan that identifies the restoration of native species, including swift fox, as a priority in the preferred alternative.

With current swift fox reintroduction efforts occurring 65 miles northeast of the park at Bad River Ranches, and a viable population of swift fox 90 miles to the west of the park in southeastern Wyoming, the prairies of Badlands National Park encompass a logical connection, or biological corridor between existing populations, for the success of swift fox recovery in South Dakota.

D. The Issues

Information concerning the issues related to reintroduction of swift fox was gathered from internal scoping sessions, from public comments received in response to a press release issued by Badlands National Park about this proposed action and from a public scoping meeting held at Badlands National Park on January 16th, 2003.

1. Effects on Agricultural Land Management Practices
A concern was raised that private land rights and management practices adjacent to the park boundary would be affected by the presence of a State listed threatened species.
Impact topics: Threatened and endangered species, Socio-economics.

2. Relationship Between Swift Fox and Recreation, Tourism, and Public Access
Commentors voiced a concern about the potential effects of swift fox reintroduction on hunting, trapping, fishing, access to public lands, and tourism.
Impact topics: Socio-economics, Visitor use, Visitor experience.

3. Intrinsic and Educational Value of Swift Fox and Their Habitat
Respondents expressed a concern of the importance of maintaining and enhancing biodiversity and restoring the prairie to former conditions. Reintroductions of native wildlife play an important role in educating the public about the complexity and interrelationship of the prairie environment and the values of grasslands beyond commodity production and market-based economics.
Impact topics: Visitor experience, Visitor use, Socio-economics.

4. Direct costs of Reintroducing Swift Fox
There was a concern that tax dollars would be spent for a reintroduction program that might be unsuccessful rather than spending that money for other purposes.
Impact topics: Socio-economics

5. Feasibility of Establishing a Viable Wild Swift Fox Population

Concerns were voiced on whether reintroduced swift fox would be able to survive on their own in the Badlands area, especially if they were once here and have since disappeared.
Impact topics: Wildlife

6. National Versus State and Local Authorities
There was a range of comments about whether local, state, or national interests should have the most authority and influence in making decisions about swift fox reintroductions.
Impact topics: Socio-economics, Environmental justice

7. Interaction of Swift Fox with Other Wildlife
There was interest of swift fox as predators and their role in the system and effects on other species, particularly game bird and songbird populations.
Impact topics: Wildlife, Threatened and endangered species.

8. Effects of Potential Future Designation of Species as Endangered
Concerns were voiced about the potential ramifications of private land use and owners rights if the swift fox would become a Federally listed species.
Impact topics: Threatened and endangered species, Socio-economics, Environmental justice.

II. LEGAL AUTHORITIES AND POLICIES

A. Federal Regulations
The Endangered Species Act of 1973, as amended, directs federal agencies to take action to recover endangered species. Specifically, "It . . . is the policy of Congress that all federal departments, and agencies shall seek to conserve endangered and threatened species . . . " (Section 2 (c)), and ". . . to use all methods and procedures which are necessary to bring any endangered or threatened species to the point which the measures provided in this Act are no longer necessary" (Section 3 (3)). Although swift fox are not a Federally Listed species, this regulation applies to this proposed action due to NPS *Management Policies* (2001) – 4.4.2.3 below.

B. NPS Policy
This proposal describes a swift fox reintroduction that is consistent with NPS *Management Policies* (2001). The most relevant sections are provided below:

4.4.2.3 Management of Threatened or Endangered Plants and Animals
The National Park Service will inventory, monitor, and manage state and locally listed species in a manner similar to its treatment of federally listed species, to the greatest extent possible.

4.1.5 Restoration of Natural Systems
The Service will re-establish natural functions and processes in human-disturbed components of natural systems in parks unless otherwise directed by Congress. The Service will use the best available technology, within available resources, to restore the biological and physical components of these systems, accelerating both their recovery and the recovery of landscape and biological-community structure and function. Efforts may include, for example: . . . 6) restoration of native plants and animals.

4.4.1 General Principles for Managing Biological Resources

The National Park Service will maintain as parts of the natural ecosystems of parks all native plants and animals. The Service will achieve this maintenance by: a) Preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur; b) Restoring native plant and animal populations in parks when they have been extripated by past human-caused actions . . .

4.4.1.1 Plant and Animal Population Management Principles

In addition to maintaining all native plant and animal species and their habitats inside parks, the Service will work with other land managers to encourage the conservation of the populations and habitats of these species outside parks whenever possible.

4.4.2.2 Restoration of Native Plant and Animal Species

The Service will strive to restore extirpated native plant and animal species to parks whenever all of the following criteria are met:

- Adequate habitat to support the species either exists or can reasonably be restored in the park, and if necessary also on adjacent public lands and waters, and once a natural population level is achieved, the population can be self-perpetuating; *(*feasibility studies associated with swift fox reintroductions indicate that adequate habitat exists in western South Dakota.)*
- The species does not, based on an effective management plan, pose a serious threat to the safety of people in the parks, park resources, or persons or property outside park boundaries*;(*since this proposed action is an experimental reintroduction of swift fox, a management plan for swift fox does not currently exist. Due to the small size of swift fox, a serious safety threat is not expected.)*
- The genetic type used in restoration most nearly approximates the extirpated genetic type; and *(*swift fox translocation candidates will come from the nearest known healthy populations in eastern Wyoming or northern Colorado.)*
- The species disappeared, or was substantially diminished, as a direct or indirect result of human-induced change to the species population or to the ecosystem. *(*the decline of swift fox can be attributed to the agricultural conversion of the Great Plains, the lethal poisoning of wolves, and the subsequent change in the canid community to a coyote dominated system with increased competition with swift fox.)*

C. State Regulations

Specific state regulations related to swift fox reintroduction in South Dakota include:

South Dakota Codified Law § 34A-8-8: Threatened and Endangered Species. "The secretary of agriculture and the secretary of game, fish and parks may permit the taking, possession, purchase, sale, transportation, exportation, or shipment of species of plants or wildlife which appear on the state list of endangered or threatened species for scientific, zoological, or educational purposes, for propagation in captivity of such fish or wildlife to insure their survival."

South Dakota Codified Law § 34A-8-10. Importation, possession, and sale authorized under permit. "A species of wildlife appearing on any of the lists enumerated in § 34A-8-

9 may enter South Dakota from another state or from a point outside the territorial limits of the United States and may be transported, possessed, and sold in accordance with the terms of a permit issued pursuant to rules promulgated by the Game, Fish and Parks Commission pursuant to chapter 1-26".

Further, the Wyoming Game and Fish Commission Regulations, Chapter 10, Section 5: Importation/Possession Permit Required For Live Wildlife, state: "Except as exempted in this regulation, a permit from the Department is required prior to importation, possession, confinement, and/or transportation of any living wildlife. Any living wildlife may be transported through the state of Wyoming if the person transporting said wildlife is in possession of a valid permit for interstate transportation of live wildlife. An interstate transportation permit shall be valid as long as live wildlife are confined within the conveyance. It shall be a violation of this regulation to intentionally or unintentionally release within Wyoming from the transporting conveyance any wildlife held under an interstate transportation permit."

Wyoming Game and Fish Commission Regulations, Chapter 33, Section 4. Scientific or Educational Permits**.** "Scientific or educational permits may be issued by the director of the Wyoming Game and Fish Department or his designee to duly authorized agents of institutions of higher education, of governmental entities and other persons of science or education for scientific, research or educational purposes to take wildlife under the following conditions:

> To receive consideration, . . . The application shall present, in detail, a list of the species to be taken, the numbers to be collected and/or possessed, the specific Game and Fish Department administrative region(s) where species are to be possessed and/or collections are to be made and the methods of collection to be used. It shall state the purpose for which such possession and/or collections will be made and the expected benefits to science, research, education or department wildlife management goals. It shall also provide detailed information describing the project or activity which requires the issuance of a permit. Copies of any required federal permits for the take or possession of wildlife**,** if applicable, shall accompany the permit application."

The Colorado Division of Wildlife Rules and Regulations, Chapter 0 – General provisions, Article VI, #006.5, B. states:

> "Any exportation of live wildlife held under authority of Colorado Wildlife Parks or Lakes Licenses shall be in accordance with the rules and regulations of the receiving country, state or province."

Further, Chapter 13 of the Colorado regulations specifically addresses the possession of wildlife, scientific collecting, and special licenses. Article III, #1315 states:

> "A scientific collecting license may be issued for the purpose of marking or banding or temporary or permanent possession of wildlife and collection of wildlife specimens outside of established seasons and bag limits, for the purpose of collecting scientific data."

III. ALTERNATIVES

A. *Alternative A: No action*

Swift fox would not be released into the Badlands area.

Current monitoring efforts for swift fox would continue opportunistically during spring and fall coinciding with ferret spotlight surveys and coyote fecal line transect surveys. No proactive steps would be taken to restore this species into the park.

B. *Alternative B: Reintroduce swift fox with hard release methods*

Swift fox would be released into Badlands National Park.

In cooperation with U.S.G.S. Northern Prairie Wildlife Research Center and, South Dakota State University-Department of Wildlife and Fisheries a swift fox reintroduction plan would be established to implement and research the following:

1. The specific areas within Badlands National Park suitable for reintroduction of swift fox based on landscape and habitat characteristics.
2. Estimate relative density using methods established by Knowlton (1984) and Stoddart et al. (2001) and spatial characteristics of the coyote population within the proposed area with GPS tracking using Badlands National Park (2001)(2000) protocols.
3. Identify the demographic characteristics of reintroduced and wildborn swift fox by documenting survival rate, reproductive rate, dispersal rate and home range with radio collar tracking.
4. Compare survival rates and reproductive rates of swift foxes restored to areas with reduced coyote densities through control (Bad River Ranches) and without coyote control but with release sites located on the periphery of coyote territories (Badlands).
5. Evaluate the use and importance of prairie dog colonies relative to swift foxes. Examine survival, mortality, and reproduction rates of swift foxes with and without access to prairie dog towns.

Turner Endangered Species Fund, as cooperators, would assist with the logistics or the reintroduction effort.

Based on current permit applications with the State of Colorado and the State of Wyoming, approximately 30 (50:50 sex ratio) wild swift fox per year would be live captured, using baited box traps, from outside South Dakota during the next three years. All swift fox will be dusted for ectoparasites upon capture and tested for canine distemper, tularemia, and sylvatic plague. Any fox that is confirmed to be disease positive will be released at the capture location. Once all captured foxes have passed the initial disease testing they will be transported to a quarantine pen system at the park. The quarantine pen system will be physically enclosed to exclude domestic dogs, cats, other domestic pets, wild carnivores, and unauthorized personnel. Necessary capture, handling and transport permits would be obtained from the states of origin and the State of South Dakota. Once the animals pass the necessary 14-day quarantine period, following an established quarantine protocol and associated disease tests, they would be radio collared and prepared for release. Swift fox that become ill during quarantine

will be subjected to an extended quarantine and further disease tests. Fox that die during quarantine will be sent for necropsy, with all adjacent penned fox ineligible for release until test results are received. The method of release would be limited to taking the swift fox from the quarantine pens to a pre-designated release site in a portable kennel and the door would be opened for a hard release into the park. Released swift fox would be monitored utilizing vehicle-mounted, aerial, and hand-held telemetry to document survival, dispersal, behavior and habitat use for one year post-release.

This alternative would entail the erection of a temporary chain link pen cluster (footprint of approximately 1800 sq. feet) within the park for quarantine and holding of swift fox. The pen cluster would be placed in a previously disturbed area between the Maintenance Shop and the horse pasture. The pens would be removed at completion of this project.

C. *Alternative C: Reintroduce swift fox with a combination of release methods*

Swift fox would be released into Badlands National Park. This is the proposed action alternative.

In cooperation with U.S.G.S. Northern Prairie Wildlife Research Center and South Dakota State University-Department of Wildlife and Fisheries a swift fox reintroduction plan would be established to implement and research the following:

1. The specific areas within Badlands National Park suitable for reintroduction of swift fox based on landscape and habitat characteristics.
2. Estimate relative density using methods established by Knowlton (1984) and Stoddart et al. (2001) and spatial characteristics of the coyote population within the proposed area with GPS tracking using Badlands National Park (2001)(2000) protocols.
3. Identify the demographic characteristics of reintroduced and wildborn swift fox by documenting survival rate, reproductive rate, dispersal rate and home range with radio collar tracking.
4. Compare survival rates and reproductive rates of swift foxes restored to areas with reduced coyote densities through control (at Bad River Ranches) and without coyote control but with release sites located on the periphery of coyote territories (at Badlands).
5. Evaluate the use and importance of prairie dog colonies relative to swift foxes. Examine survival, mortality, and reproduction rates of swift foxes with and without access to prairie dog towns.
6. Compare survival rates and reproductive rates between swift foxes that are hard released and swift foxes that are soft released.

Turner Endangered Species Fund, as cooperators, would assist with the logistics or the reintroduction effort.

Capture, handling, transport and quarantine of swift fox in this alternative would be identical to procedures described in *Alternative B*.

A combination of release methods would be implemented to compare differences in survivorship. The hard release method would be used as in *Alternative B*. A soft release method would consist of releasing the quarantined swift fox into a small cage

surrounding an artificial den at the release sites. The animal would be allowed to use this small structure for as long as it wanted for denning and escape cover. Another soft release method would involve opening the door of the quarantine pen and allowing the fox to leave on its own. Released swift fox would be monitored utilizing vehicle-mounted, aerial, and hand-held telemetry to document survival, dispersal, behavior and habitat use for one year post-release.

This alternative allows for adaptations in the management of the reintroduction process based on success of past and on-going release program methods. This alternative would entail the erection of a temporary chain link pen cluster (footprint of approximately 1800 square feet) within the park for quarantine and holding of swift fox. Small artificial dens would also be constructed at the release sites, each with a footprint of 15 square feet. The pens and artificial dens would be removed at completion of this project.

At the end of this experimental release a swift fox population is established, a thorough swift fox management plan will be formulated.

D. Alternatives Considered but Dismissed

An alternative that was considered but dismissed was capturing wild swift fox and establishing a captive breeding facility. The breeding facility could be managed to increase mating success and survivorship of young. Surplus young from each year could then be released into the wild. This alternative was dismissed due to the fiscal, time and energy commitments that would be necessary to build, staff, and maintain a year-round animal husbandry facility. Based on similar breeding facilities that have been established for other species such as the black-footed ferret, these types of breeding facilities contribute to animal habituation to humans and loss of crucial instincts needed to survive in the wild, with higher survival rates experience by wildborn translocates (Biggins et al. 1998, Vargas and Anderson 1999, Carbyn et al. 1994).

IV. AFFECTED ENVIRONMENT

A. Natural Resources

1. Paleontological Resources:

The White River Badlands contain the largest assembly of known late Eocene and Oligocene mammal fossils. The area is the birthplace of vertebrate paleontology in North America beginning with the description of a titanothere mandible in 1846 by Dr. Hiram Prout. Since then numerous important finds from the area have served to define the geologic period. Oligocene fossil remains include camels, three-toed horses, oreodonts, antelope-like animals, rhinoceroses, false deer, rabbits, beavers, creodonts, land turtles, rodents and birds.

Marine fossils are found in deposits of an ancient sea that existed in the region some sixty-five to eighty million years ago during the Cretaceous period. Fossils found in the Pierre Shale and Fox Hills Formations include ammonites, nautiloids, fish, marine reptiles and turtles.

The spectacular vertebrate fossils preserved within the White River Badlands have been studied extensively since 1846 and are included in museum collections throughout the world. Small percentages of the Badlands National Park have been surveyed for fossil resources. Most of these areas consist of historic research sites (Clark et al., 1967) and small-scale projects completed by individual contracts and paleontological interns (Terry, 1995; Cicimurri, 1995; Lala, 1996; Martin and McConnell, 1998; Martin and DiBenedetto, 1997,1998). A pre-construction survey was completed along the Badlands Loop Road in 1996, 1997 and 1998 (Benton, 1998). A three-year baseline survey of fossil bone beds in the Scenic Member of the Brule Formation began in the summer of 2000. Very little paleontological data has been entered into the park Geographic Information System (GIS). More paleontological sites will be recorded in GIS once the program has fully expanded.

2. Wildlife Resources

There are a variety of wildlife resources that occupy woodlands, shrublands, and grasslands of Badlands National Park, including small mammals, ungulates, birds, reptiles, amphibians and invertebrates. There are at least fifty-five documented mammalian species within the park including five species of ungulates, more than 120 species of birds, over nineteen species of reptiles and amphibians, twenty-eight known species of lepidoptera along with numerous other arthropod species.

Common small mammal species observed include the Desert Cottontail (Sylvilagus audubonii), Eastern Cottontail (*Sylvilagus floridus*), Thirteen-lined Ground Squirrel (*Spermophilus tridecemlineatus*), Black-tailed, Prairie Dog (*Cynomys ludovicanus*), Deer Mouse (*Peromyscus maniculatus*) and Muskrat (*Ondontra zibehicus*) and numerous other smaller rodents. Common meso-carnivores include the Coyote (*Canis latrans*), Bobcat (*Felis rufus*), Red Fox (*Vulpes vulpes*) and American Badger (*Taxidea taxus*).

Ungulates within the park include mule deer (*Odocoileus hemionus)*, White-tailed Deer (*O. virginianus)*, Pronghorn Antelope (*Antilocapra americana)*, Bison (*Bison bison)*, and Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*). Bison were restored to the park in 1963 and now number more than 700 animals. Bighorn sheep were also restored to the park in 1967 to fill the ecological niche formerly occupied by the now extinct Audubon's Bighorn Sheep. There are currently between forty-eight and seventy-four animals. In order to boost the population's genetics and reproductive capabilities the park is currently searching for other animals to translocate to Badlands National Pak

Common amphibians found within Badlands National Park include the Plains Spadefoot Toad (*Scaphiopus bombifrons*), Great Plains Toad (*Cognatus bufonidae*) and the Chorus Frog (*Pseudacris triseriata*). Some common reptiles include the Red-sided Garter Snake (Thamnophis sirtalis), Western Plains Garter (*Thamnophis radix*), Western Plains Hinges (*Heterodox nascius*), Bullsnake (*Pituophis melanoleuc*) and Prairie Rattlesnake (*Crotalus viridis*).

Common bird species within Badlands National Park include the Northern Harrier (*Circus cyaneus*), Ferruginous Hawk (*Buteo regalis*) , Red-tailed Hawk (*Buteo jamaicensis*), Prairie Falcon (*Falco mexicanus*), Sharp-tailed Grouse (*Tympanuchus phasianellus*), Killdeer *(Charadrius vociferus*), Mourning Dove (*Zenaida macroura*), Burrowing Owl (*Athene cunicularria*), Red-headed Woodpecker (*Melanerpes*

erythrocephalus), Northern Flicker (*Colaptes auratus*), Eastern Kingbird (*Tyrannus tyrannus*), Bell's Vireo (*Vireo bellii*), Warbling Vireo (*Vireo gilvus*), Black-billed Magpie (*Pica pica*), American Crow (*Corvus brachyrhynchos*) Bank Swallow (*Riparia riparia*), Cliff Swallow (*Hirundo pyrrhonota*), Barn Swallow (*Hirundo rustica*), Mountain Bluebird (*Sialia currucioides*), American Robin (*Turdus migratorius*), Field Sparrow *(Spizella pusilla*), Dickcisssel (*Spiza americana*), and Red-winged Blackbird (*Agelaius phoeniceus*).

Common butterfly species found within Badlands National Park include the Eastern Tiger Swallowtail (*Pterourus glaucus*), Checkered White (*Pontia protodice*), Cabbage White *(Pieris rapae*), Clouded Sulphur (*Colias philodice*), Striped Hairstreak (*Satyrium liparops*), Melissa Blue (*Lycaeides melissa*), Regal Fritillary (*Speyeria idalia*), Atlantis Fritillary (*Speyeria atlantis*), Variegated Fritillary (*Euptoieta claudia*), Pearl Crescent (*Phyciodes tharos tharos*), Wiedemer's Admiral (*Basilarchia weidemeyerii*), Viceroy (*Basilarchia archippus*), Mourning Cloak (*Nymphalis antiopa*), Red Admiral (*Vanessa atalanta*), Painted Lady (*Vanessa cardui*), Hackberry Emperor (*Asterocampa celtis*), Common Wood Nymph (*Cercyonis pegala*) Common Checked Skipper (*Pyrgus communis*) and the Delaware Skipper (*Anatrytone logan*). Several species of grasshoppers and crickets (Orthoptera) along with Elm leaf Beetles (*Pyrrhalta luteola*) and Elm bark Beetles (*Scolytus multistriatus*) are also common within Badlands National Park.

3. Vegetation

Badlands National Park preserves an excellent example of native mixed grass prairie and protection of the prairie environment is recognized as one of the park's purposes. Slightly more than half of the parks land area is vegetated, the balance being primarily eroded badlands, as indicated by the parks Vegetation Mapping project (Von Loh et al 1999). The vegetation is dominated by western wheatgrass prairie (36 percent) and more rarely other types of prairies (10 percent) interspersed with shrublands (4 percent) and woodlands (1.5 percent). Typical grassland species include western wheatgrass (*Agropyron smithii*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), buffalograss (*Buchloe dactyloides*), little bluestem (*Schizachyrium scoparium*), side oats grama (*Bouteloua curtipendula*), ricegrass (*Achnatherum hymenoides*), threadleaf sedge (*Carex filifolia*), and a wide variety of annual and perennial forbs. Typical shrubland species include western snowberry (*Symphoricarpos occidentalis*), skunkbush sumac (*Rhus trilobata*), sand sagebrush (*Artemisia filifolia*), silver sagebrush (*Artemisia cana*), prairie sandreed (*Calamovilfa longifolia*), prickly-pear cactus (*Opuntia polyacantha*), rubber rabbitbrush (*Chrysothamnus nauseosus*), and Japanese brome (*Bromus japonicus*). Typical woodland species include green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), American plum (*Prunus americana*), chokecherry (*Prunus virginiana*), cottonwood (*Populus deltoides*), Rocky Mountain juniper (*Juniperus scopulorum*), wild rose (*Rosa arkansana*), and sandbar willow (*Salix exigua*).

4. Threatened and Endangered Species

The Endangered Species Act of 1973 requires disclosure of impacts of federal actions on all federally protected threatened and endangered species. NPS *Management Policies* (2001) require assessment of impacts to certain state-listed rare, candidate,

declining and sensitive species. Within the state of South Dakota there are a total of 35 threatened, endangered, and candidate species of invertebrates, fishes, reptiles, amphibians, birds, mammals, and plants. From this list there are a total of three avian and three mammalian species documented as known, or potential to be, resident or migrant species within the local area of Badlands National Park. Listed bird species that are migrant and seasonally resident in the area are the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), and whooping crane (*Grus americana*). The park includes large black-tailed prairie dog colonies (*Cynomys ludovicianus*), providing habitat for the reintroduced federally-listed endangered black-footed ferret (*Mustela nigripes*) and potential habitat for the state-listed threatened swift fox (*Vulpes velox*). Furthermore, the black-tailed prairie dog is considered a candidate species for federal listing as threatened. Prairie dog communities occur throughout the park and within the proposed swift fox release area. Direct impacts to these communities and the six species mentioned above are therefore analyzed in this EA. Two state-listed rare plants are known to occur in the vicinity of the park: Dakota buckwheat (*Eriogonum visheri*) and Barr's milkvetch (*Astragalus barrii*). However, both occur on sparsely vegetated badlands where no ground disturbance associated with swift fox releases is planned; therefore, impacts to these two plant species are not analyzed.

B. Cultural Resources

Badlands National Park lies within the White River Badlands Archaeological Region as it is defined in the South Dakota State Plan for Archaeological Resources. The Badlands region is considered the Plains Culture Area. Archaeologists have defined the Plains Culture on the basis of the character of material remains from prehistoric sites and have outlined a sequence of changes in those remains. The archaeological resources of Badlands National Park have been divided into four periods: Paleo-Indian (11,500 - 8,000 B.P.), Plains Archaic Tradition (8,000 - 1,500 B.P.), Late Prehistoric (1,500 to 1700s), and Protohistoric (most recent period).

While extensive cultural reconnaissance has not been conducted, approximately 10 percent of the North Unit of the park has been surveyed for archaeological resources. As of the June, 2000 Cultural Sites Inventory, 283 sites had been identified. Additional sites are known but final reports have not been received. 100 sites have been inventoried for site condition with the bulk falling in the fair condition range. The sites are primarily artifact scatters, lithic scatters, or "open" sites.

The known archaeological record of cultures in the Badlands area dates back to 11,500 before present. (B.P.) Since about 1000 B.P., the region has been occupied by nomadic groups subsiting by hunting and gathering. In the mid-eighteenth century, the Oglala and Brule bands of the Teton Sioux moved west of the Missouri River to occupy the Badlands Area.

Homesteads are typically manifested as scatters of historic materials, including glass, metal, ceramics, remnants of old corrals, dugouts, fence lines, well, foundations, discarded household items, and building materials. These date from the 1910s through 1930s.

No parkwide inventories have been initiated to evaluated whether there are National Register-eligible historic structures, cultural landscapes, or any ethnographic resources. One structure, the Ben Reifel Visitor Center, was determined in 2002 as eligible for the National Register. Potentially eligible archaeological and other cultural resources may be affected by fire events. Consultation with the State Historic Preservation Officer has been consistent and documented on all undertakings shared with the cultural resource manager.

C. Visitor Experience

Recreational visits to Badlands National Park totaled 927,762 in 2002. Visitation has generally been stable at 925,000 to 1,000,000 since the early 1980s. A 2000 Visitor Survey conducted by the National Park Service Cooperative Studies Unit indicated that 81 percent of park visitors arrive either in a family or friend group intending to spend 2 to 4 hours in the park. 64 percent stated that the protection of endangered species was very to extremely important to them while 75 percent felt that preservation of the native prairie ecosystem was very to extremely important to them in the context of the mission of Badlands National Park. The swift fox, although not a federally listed species, is a species of concern at Badlands National Park, making the visitor perspective on endangered species pertinent to the visitor experience relating to swift fox reintroduction. Additionally, as a part of the native mixed grass prairie ecosystem, visitors interested in this topic would benefit from a fuller complement of ecosystem inhabitants.

Peak visitation season is May 20 through October 1. This peak season has extended over the past decade from the traditional Memorial Day to Labor Day period. Spring and fall brings dozens of organized bus tours to the park, primarily senior citizens or international visitor groups. Visitors to the park list viewing scenery and wildlife, exploring the visitor center, use of wayside exhibits, and hiking on maintained trails as the most popular activities.

Badlands National Park is open to horseback use anywhere except on marked trails, roads, highways, and developed areas. Nearly all horse use is confined to the Badlands Wilderness Area, accessing through Sage Creek Campground in the northwest corner of the park. These visitors are most likely to view wildlife as they explore the roadless areas several miles from developed areas.

D. Socioeconomic Environment

Badlands National Park is located in three counties of rural South Dakota – Jackson, Pennington, and Shannon. Besides the revenue created through tourism, a majority of local economy surrounding the park is based on livestock production and agriculture. The adjacent U.S. Forest Service - Buffalo Gap National Grasslands provide livestock grazing leases and recreational access for public hunting and fishing. Public use and visitation of the park and surrounding grasslands provides revenue for the local communities of Interior, Wall, and Kadoka throughout the year.

V. ENVIRONMENTAL CONSEQUENCES

The National Environmental Policy Act requires that environmental documents disclose the environmental impacts of the proposed federal action, reasonable alternatives to that action, and any adverse environmental effects that cannot be avoided should the proposed action be implemented. The section analyzes the environmental impacts of the three alternatives for swift fox reintroduction on natural resources, cultural resources, visitor experience and socioeconomic environment. This analysis provides the basis for comparing the effects of the alternatives. In considering the impacts both the intensity and the duration of the impacts, mitigation measures and cumulative impacts were assessed.

Methodology

The National Park Service based this impact analysis and conclusions on the review of existing literature and park studies; information provided by experts within the National Swift Fox Conservation Team, the National Park Service, and other agencies; and professional judgments and park staff insights.

A. Impact Topics Considered

Wildlife
The direct, cumulative and indirect affects of swift fox restoration on populations of small mammals, ungulates, birds, reptiles, amphibians, and invertebrates will be analyzed in this EA.

Paleontological resources
Badlands National Park is world renowned for its paleontological resources. A report that accompanied the 1929 Act creating the park described the Badlands as containing “vast beds of vertebrate remains.” The spectacular vertebrate fossils preserved within the White River Badlands have been studied extensively since 1846 and are apart of museum collections throughout the world. Fossil resources may be indirectly impacted by digging during the construction of swift fox release sites and/or holding pens. Therefore, direct impacts to fossil resources will be analyzed in this EA.

Threatened and Endangered Species
The Endangered Species Act of 1973 requires disclosure of impacts of federal actions on all federally protected threatened and endangered species. NPS *Management Policies* (2001) require assessment of impacts to certain state-listed rare, candidate, declining and sensitive species. The direct and indirect affects of swift fox reintroduction on state and federal threatened and endangered species are analyzed in this EA.

Visitor Experience
Through the 2000 Visitor Survey, Badlands National Park's visitors 64 percent stated that protection of endangered species was very to extremely important to them and 75 percent stated that preservation of the native prairie ecosystem was very to extremely important to them in the context of the mission of Badlands National Park. Due to this

high level of importance placed on wildlife issues, direct impacts to visitor experience will be analyzed in this EA.

B. Impact Topics Considered But Not Further Addressed in this EA

Air Quality

The Badlands Wilderness Area is a Class I airshed as designated by the federal 1963 Clean Air Act (42 U.S.C. 7401 et. seq. as amended). This designation stipulates that federal land managers have an affirmative responsibility to protect a park's air quality from adverse air pollution impacts. Implementation of swift fox releases has no potential to affect air quality. Therefore, this impact topic is not included for further analysis in this EA.

Vegetation

NPS *Management Policies* (2001) directs the parks to preserve native plants. Furthermore, one of the park's purposes is to preserve the flora, fauna and natural processes of the mixed grass prairie ecosystem prairie. This prairie environment provides habitat for many species of wildlife and could provide suitable habitat for swift fox. However, implementation of swift fox releases has no potential to affect vegetation. Therefore, this impact topic is not included for further analysis in this EA.

Water Resources

National Park Service policies require protection of water resources consistent with the Clean Water Act. Reintroduction of swift fox into Badlands National Park would not impact surface or subsurface water resources. Therefore, direct impacts to water resources will not be included for further analysis in this EA.

Geologic Resources

National Park Service policies require protection of geologic resources and processes. Implementation of swift fox releases would not have any affect on geologic resources. Therefore, this impact topic is not included for further analysis in this EA.

Cultural Resources

In consultation under section 106 of the National Historic Preservation Act of 1966 with the State Historic Preservation Office (SHPO) for the State of South Dakota, the SHPO has determined that there are no adverse impacts to the cultural resources of Badlands National Park through the reintroduction of the swift fox. Subsurface archeological materials may be discovered during the implementation of the proposed action alternative, but will be mitigated through the monitoring associated with Paleontological Resources. Therefore, this impact topic is not included for further analysis in this EA. A letter recording this consultation is on file in the Badlands National Park Cultural Resource Management files.

Socio-economics

National Environmental Protection Act requires an analysis of impacts to the human environment that includes economic, social, and demographic elements in the affected area. The area surrounding the park is primarily ranch land with a few small communities. The presence of a small, five pound canine would not cause predation on local livestock, would not affect agricultural practices, and would not limit public access. The current State of South Dakota legislation of threatened species status prohibits the

direct take or possession of a swift fox, but does not prohibit or punish incidental take associated with fur trapping activities. The reintroduction of swift fox into Badlands National Park in either of the proposed action alternatives would have no appreciable affect on the communities' overall population, income, or employment base. Therefore, this impact topic is not included for further analysis in this EA.

Environmental Justice

Executive Orders 12250, 12898 and 12948 require agencies to consider the impact of their actions on disadvantaged human populations. The Pine Ridge Indian Reservation is an economically depressed area that is adjacent to Badlands National Park. Implementation of swift fox releases would have no affect on the quality of life of the Oglala Lakota people. Therefore, this impact topic is not included for further analysis in this EA.

Visitor Use

NPS *Management Policies* (2001) require parks to provide for visitor use. Implementation of swift fox releases would have no affect on visitor use in the park therefore this impact topic is not included for further analysis in this EA.

Human Health and Safety

NPS *Management Policies* (2001) advocate a safe work environment for employees and a safe experience for park visitors. Handling of swift fox will be conducted by trained personnel. The swift fox will be quarantined before release into the park to prevent the spread of any potential disease. Because of these safety precautions, no actions proposed would likely affect human health or safety for park employees or visitors. Therefore, this impact topic is not included for further analysis in this EA.

Park Operations

Implementation of swift fox releases (*Alternatives B or C*) would not substantially affect park operations. Funding for it's implementation would come from new sources or continuation of existing funding used for wildlife management. There would likely be a negligible increase in administrative support for personnel and procurement as well as increased storage space needs. However, the park already provides those services and can absorb the small increases associated with an increase in the swift fox program. Because these impacts are negligible, this impact topic is not included for further analysis in this EA.

Wilderness

The Wilderness Act of 1964 (16 USC 1132) and the NPS Wilderness Management Guidelines and Policies require consideration of impacts on Wilderness resources. Public Law 94-567 established the 64,250-acre Badlands Wilderness Area in Badlands National Park. The intent of the designation is to preserve wilderness values, that is, wilderness visitor experience and physical wilderness character. Swift fox releases are not planned to occur within the wilderness area of the park. Released fox may disperse into the wilderness area, but the presence of this native species would not have an impact on wilderness values and are therefore not analyzed in this EA.

C. Impact Intensity and Duration

For the purposes of this analysis, intensity or severity of the impact in this analysis is defined as follows:

Negligible – impact to the resource or discipline is barely perceptible and not measurable and confined to a small area.

Minor – impact to the resource or discipline is perceptible and measurable and is localized.

Moderate – impact is clearly detectable and could have appreciable effect on the resource or discipline.

Major – impact would have a substantial, highly noticeable influence on the resource or discipline.

The duration of the impacts in this analysis is defined as follows:

Short term - impacts are those that occur during implementation of the alternative, including release activities – less than six months.

Long term – impacts would extend beyond implementation of the alternative and would likely have permanent effects on the resource of discipline – greater than six months.

D. Cumulative Impacts

A cumulative impact is described in regulations developed by the Council on Environmental Quality, 40 CFR 1508.7, as follows: a *"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.*

Cumulative impacts were determined by combining the impact of the action alternatives (A*lternatives B and C*) with potential impacts of other past, present and reasonably foreseeable future actions. Both of the action alternatives (A*lternatives B and C*) of restoring a native species are consistent with the Badlands National Park General Management Plan (in draft) and the Land and Resource Management Plan (U.S. Forest Service 2001) for the adjacent Buffalo Gap National Grasslands.

Based on public scoping used in the preparation of this document, the most prevalent public concern was over any potential future federal listing of the swift fox as a threatened or endangered species under the Endangered Species Act once a population was established in the Badlands National Park area. If a population of swift fox is established in Badlands National Park as a result of this proposed action, and the U.S. Fish and Wildlife Service designates the species as a candidate for listing, it could be

possible to implement a Candidate Conservation Agreement with Assurances for this swift fox population that will protect private land rights and address the concerns of the public. It is unlikely at this time that swift fox will be designated as a candidate for federal listing in view of the current range wide distribution and extent of populations throughout the United States. Another population of swift fox in the Badlands National Park area, if a self-sustaining population was established by this proposed action, would only add to the national recovery effort and reduce the likelihood that the species would be listed in the future.

E. Mitigation Common to Alternatives B and C

Under the proposed release methods of swift fox in these alternatives there will be minimal ground surface disturbance at the release sites for the construction of artificial dens and at the quarantine facilities for the erection of the holding pens. Should any cultural resources be discovered as a result of construction activities, every effort would be made to avoid them by design. Should avoidance prove impossible, data recovery would be undertaken with the South Dakota SHPO, affiliated tribes, and Advisory council on Historic Preservation, as appropriate. If human remains were inadvertently discovered as a result of construction activities, work would be stopped in the discovery area. The discovery would be protected, and the NPS would consult about treatment strategies and disposition of the remains as stipulated by the Native American Graves Protection and Repatriation Act and its implementing regulations.

Every effort would be made to <u>not</u> construct artificial dens and holding pens on bedrock. During constructions operations, a paleontologist will monitor for fossil resources. If fossils were discovered activities would be stopped in the area of discovery. The park paleontologist would determine the best course of action for recovering the fossils. All collected fossils would be incorporated into the NPS museum collection.

During the construction and erection activities in the holding, quarantine and release of swift fox, all efforts will be made to minimize the visual obtrusiveness of the associated hardware (holding pens and artificial dens) in the landscape. Sites will be chosen that are not easily seen from common visitor areas and/or roads. Materials used for construction will be treated or painted to camouflage with natural surrounding colors and limit reflectiveness.

F. Impacts of Alternative A – No Action. Swift fox would not be released

1. Paleontological Resources:

Under this alternative, there would be no ground disturbing construction of dens and holding pens, thus not impacting paleontological resources. The above listed impacts of no action would have no negative impacts to paleontological resources. A measurable fashion would include one fossil specimen damaged in a specific area.

<u>Conclusion:</u>

The above listed impacts of no action would have no negative impacts to paleontological resources.

Cumulative Impacts:

Based on the potential of no short-term negative impacts and the long-term no negative impacts to paleontological resources, implementation of this alternative would not adversely affect paleontological resources.

2. Wildlife Resources:

Under this alternative, the state-threatened swift fox would not be reintroduced into the park. The abundance, distribution, and general health of wildlife populations that would be potential prey for swift fox would experience negligible, if any, impacts with the lack of this predator in the local system.

Conclusion: No negative direct or indirect impacts to other wildlife resources would occur.

Cumulative Impacts: There would no impacts to other wildlife species as a result of this no action alternative.

3. T&E Species:

Under this alternative, the state-threatened swift fox would not be reintroduced into the park. The last confirmed sighting of this native species in the park was in the late 1980's with no known populations existing today. Without reintroductions of this species, it is unlikely that a viable population will establish itself in the park. The other threatened and endangered species within the park would not be impacted by this no action alternative. Protection, habitat preservation, and monitoring of these other T&E species would continue.

Conclusion: Lack of proactive steps at swift fox recovery within the park would have long term major impacts on native swift fox abundance and park biodiversity through the lack of representation of this species. Without the presence of swift fox in the park, a predator niche would be void, and the associated predation would not occur.

Cumulative Impacts: No reintroduction effort would mean that swift fox would continue to be absent from the park for the foreseeable future. Failure to restore a state-listed species where suitable habitat is available would not be in compliance with National Park Service policy. Although the lack swift fox reintroductions would adversely impact swift fox populations, or the lack of, within the park, implementation of this alternative would result in long-term minor adverse impacts to T&E species on the whole.

3. Visitor Experience:

Under this alternative, without the reintroduction of swift fox, visitors would not have the opportunity to view a more complete roster of native prairie wildlife in the Badlands ecosystem. Since the swift fox is currently considered extirpated from the White River Badlands, visitors have no opportunity to observe this native species at Badlands National Park. Park visitors regularly encounter large and small mammals, such as deer, pronghorns, prairie dogs, and bison, as well as birds and reptiles. These species are all native to the Badlands and contributing elements to a prairie ecosystem.

Conclusion: Visitors to Badlands National Park would experience a less diverse complement of native park wildlife.

Cumulative Impacts
Over time, visitors may come to accept that an incomplete ecosystem is still a functional ecosystem and not feel that species restoration is important.

G. Impacts of Alternative B - Reintroduce swift fox with hard release method

1. Paleontological Resources:

This alternative would entail the erection of a temporary chain link pen cluster (footprint of approximately 1800 sq. feet) within the park for quarantine and holding of swift fox creating a small amount of ground disturbance. This ground disturbance has the potential to impact paleontological resources in a measurable fashion. A measurable fashion would include one fossil specimen damaged in a specific location. If efforts were made to place the compound in a location where no bedrock was exposed, under this alternative, negative impacts to paleontological resources would be negligible.

Conclusion:

If efforts were made to place the compound in an area where no bedrock was exposed, under this alternative, negative impacts to paleontological resources would be negligible.

Cumulative Impacts

Based on the potential short-term negligible negative impacts and the long-term negligible negative impacts to paleontological resources at pen construction sites, implementation of this alternative may adversely affect paleontological resources at a negligible level in the park.

2. Wildlife Resources:

Swift fox would be restored to the ecosystem at Badlands National Park under this alternative. Some wildlife resources would be impacted by predation such as small mammals, insects, birds and reptiles. Swift fox are known to feed opportunistically and exhibit a seasonal diet that links prey use with availability (Sovada et al. 2001). Uresk and Sharps (1981) found that swift fox diets in western South Dakota consisted of small mammals (49 percent), followed by insects (27 percent), plants (13 percent), and birds (6 percent) based on collected scat analysis. Hillman and Sharps (1978) also noted that the main diet of swift fox in South Dakota consisted of mice, rabbits, and birds. Similar work conducted in western Kansas showed swift fox diets to be composed (in order of abundance) of small mammals, arthropods, birds, carrion, plants, and reptiles with mice (Cricetidae) and rabbits (Leporidae) the most common. Bird species that were most commonly found in scat included Western Meadowlarks (*Sturnella neglecta*), Mourning Doves (*Zenaida macroura*), and Chestnut-collared Longspur (*Calcarius ornatus*). Based on this diet and opportunistic feeding behavior, it is unlikely that reintroduced swift fox would exhibit negative impacts on any of these wildlife species within Badlands National

Park Current populations of these species within the Park appear to be high and in good health based on breeding bird surveys and observations by park staff.

Conclusion: Beneficial long-term impacts on wildlife resources would be the result of swift fox restoration. Direct predation of the above mentioned wildlife species would be negligible and long-term impacts on these species would also be negligible.

Cumulative Impacts Although there may be some moderate long-term adverse impacts on wildlife populations by predation, overall, restoration of the swift fox to the Badlands ecosystem would provide long-term, beneficial impacts to most wildlife resources.

3. T&E Species:

Under this proposal, swift fox would be reintroduced into Badlands National Park. The inclusion of this small canine into the area would increase the biodiversity of the Badlands ecosystem and fill a predator niche that is currently void. Swift fox exhibit opportunistic foraging behavior that results in a seasonal diet that links prey use with availability (Sovada et al. 2001). Uresk and Sharps (1981) found that swift fox diets in western South Dakota consisted of small mammals (49 percent), followed by insects (27 percent), plants (13 percent), and birds (6 percent) based on collected scat analysis. Similar work conducted in western Kansas showed swift fox diets to be composed (in order of abundance) of small mammals, arthropods, birds, carrion, plants, and reptiles. The most prominent mammals that were consumed included mice (Cricetidae) and rabbits (Leporidae). Bird species that were most commonly found in scat included western meadowlarks (*Sturnella neglecta*), mourning doves (*Zenaida macroura*), and chestnut-collared longspur (*Calcarius ornatus*). Based on this diet, it is unlikely that reintroduced swift fox would exhibit direct predation on any of the threatened and endangered species that are known to exist in Badlands National Park except for the candidate black-tailed prairie dog and possibly the endangered black-footed ferret.

The amount of direct predation on black-tailed prairie dogs and black-footed ferrets, and the associated extent of impacts to these species, by reintroduced swift fox may be correlated to the number of swift fox in the area. Home range of swift fox was estimated by Kunkel et al. (2001) for west-central South Dakota to range from 0.34 - 0.78 swift fox per mi^2 (0.13 – 0.30 per km^2) in suitable habitat. The proposed swift fox habitat within Badlands National Park is listed at approximately 29.4 mi^2 (76 km^2). An additional 95.3 mi^2 (246 km^2) of potential habitat of National Grasslands is directly adjacent to the proposed swift fox release area. These 124.7 mi^2 (322 km^2) of federal ground could potentially support 42 – 97 swift fox. It is expected that many released fox would disperse outside of this area and inhabit other lands to be part of a larger state population. Preliminary expectations for a reintroduced population of swift fox is to document survival that will increase recruitment, or the number of individuals that reach the breeding stage and produce young in the wild. A successful reintroduction would encompass an expanding population (number of births greater than the number of deaths) that approaches the upper end of the carrying capacity of the habitat, or 90-100 swift fox in the area. The Badlands National Park area, including the Buffalo Gap National Grasslands, supports one of the largest black-tailed prairie dog complexes in the state at approximately 19,000 acres of active colonies. Density estimates of black-tailed prairie dogs for 2002 in Badlands National Park was 19.4 prairie dogs per acre (unpublished data). This would create a rough estimate of 368,000 prairie dogs in the

area. The Buffalo Gap National Grasslands and Badlands National Park currently support a wild population of black-footed ferrets of approximately 220 individuals (unpublished data). There is no known documentation of swift fox predations on black-footed ferrets, but it is assumed that predations may occur. The small size of the swift fox may allow it access in to burrows used by black-footed ferrets for escape from larger known predators such as coyotes and raptors. However, this smaller size of the swift fox may give black-footed ferrets a better chance at a successful defense if/when attacked. Predator avoidance by any species is crucial for survival and sustainability of that population.

Conclusion: Reintroductions of swift fox would have beneficial long-term impacts on threatened swift-fox. The incidental direct predation of candidate black-tailed prairie dogs by reintroduced swift fox would have negligible long-term impacts based on the extent of the prairie dog population in the area. The potential direct predation of endangered black-footed ferrets or black-tailed prairie dogs by reintroduced swift fox may affect, but not likely to adversely affect the local black-footed ferret or black-tailed prairie dog populations.

Cumulative Impacts: No reintroduction effort would mean that swift fox would continue to be absent from the park for the foreseeable future. Failure to restore a state-listed species where suitable habitat is available would not be in compliance with National Park Service policy. Although there may be some negligible long-term adverse impacts on black-footed ferrets through predation by reintroduced swift fox, implementation of this alternative would have long-term, moderate beneficial impacts to threatened and endangered species on the whole.

4. Visitor Experience:

Under this alternative, visitors to Badlands National Park would have the opportunity to view swift fox in portion of their native range, increasing their understanding of the diversity of the native North American prairie. Non-visitors, such as those conducting research from a distance or website users, will have an expanded menu of topics to explore about the native wildlife of Badlands National Park.

Conclusion: Reintroduction of the swift fox to Badlands National Park will have long-term beneficial impacts on visitors to Badlands National Park through increased opportunities to view native species in their original range and through increased research resulting in expanded knowledge available through research and information dissemination.

Cumulative Impacts Over time, visitors will come to expect the presence of swift foxes in the Badlands landscape and will want to learn more about the reclusive mammal. Increased interpretation on reintroductions and prairie diversity will be needed to insure visitors relate to the agency efforts to reintroduce native species, eradicate non-native plant species, and increase the biodiversity of the mixed grass prairie.

H. Impacts of Alternative C - Reintroduce swift fox with a combination of release methods

1. Paleontological Resources:

This alternative would consist of releasing the quarantined swift fox into a small cage surrounding an artificial den. To protect paleontological resources, every effort should be made to construct the artificial den in an area where no bedrock is exposed. Excavation into bedrock can potentially disturb paleontological resources. A paleontological monitor needs to be on site during the excavation process. A measurable fashion would include one fossil specimen damaged in a specific area.

Conclusion:

Alternative C would have minor negligible impacts to paleontological resources as long as the excavation for the swift fox dens occurs in areas where bedrock is not exposed.

Cumulative Impacts:

Based on the potential short-term minor negative impacts and the long-term minor negative impacts to paleontological resources, implementation of this alternative may adversely affect paleontological resources at a minor level.

2. Wildlife Resources:

Swift fox would be restored to the ecosystem at Badlands National Park under this alternative. Some wildlife resources would be impacted by predation such as small mammals, insects, birds and reptiles. Populations of mice, rabbits, western meadowlarks (*Sturnella neglecta*) and mourning doves (*Zenaida macroura*) may be reduced.

Conclusion: Beneficial long-term impacts on wildlife resources would be the result of swift fox restoration. Direct predation of the above mentioned wildlife species would be negligible and long-term impacts on these species would also be negligible.

Cumulative Impacts Although there may be some moderate long-term adverse impacts on wildlife populations by predation, overall, restoration of the swift fox to the Badlands ecosystem would provide long-term, beneficial impacts to most wildlife resources.

3. T&E Species:

Under this proposal, swift fox would be reintroduced into Badlands National Park. The inclusion of this small canine into the area would increase the biodiversity of the Badlands ecosystem and fill a predator niche that is currently void. Swift fox exhibit opportunistic foraging behavior that results in a seasonal diet that links prey use with availability (Sovada et al. 2001). Uresk and Sharps (1981) found that swift fox diets in western South Dakota consisted of small mammals (49 percent), followed by insects (27 percent), plants (13 percent), and birds (6 percent) based on collected scat analysis.

Similar work conducted in western Kansas showed swift fox diets to be composed (in order of abundance) of small mammals, arthropods, birds, carrion, plants, and reptiles. The most prominent mammals that were consumed included mice (Cricetidae) and rabbits (Leporidae). Bird species that were most commonly found in scat included western meadowlarks (*Sturnella neglecta*), mourning doves (*Zenaida macroura*), and chestnut-collared longspur (*Calcarius ornatus*). Based on this diet, it is unlikely that reintroduced swift fox would exhibit direct predation on any of the threatened and endangered species that are known to exist in Badlands National Park except for the candidate black-tailed prairie dog and possibly the endangered black-footed ferret.

The amount of direct predation on black-tailed prairie dogs and black-footed ferrets, and the associated extent of impacts to these species, by reintroduced swift fox would be directly correlated to the number of swift fox in the area. Home range of swift fox was estimated by Kunkel et al. (2001) for west-central South Dakota to range from 0.34 - 0.78 swift fox per mi^2 (0.13 – 0.30 per km^2) in suitable habitat. The proposed swift fox habitat within Badlands National Park is listed at approximately 29.4 mi^2 (76 km^2). An additional 95.3 mi^2 (246 km^2) of potential habitat of National Grasslands is directly adjacent to the proposed swift fox release area. These 124.7 mi^2 (322 km^2) of federal ground could potentially support 42 – 97 swift fox. It is expected that many released fox would disperse outside of this area and inhabit other lands to be part of a larger state population. Preliminary expectations for a reintroduced population of swift fox is to document survival that will increase recruitment, or the number of individuals that reach the breeding stage and produce young in the wild. A successful reintroduction would encompass an expanding population (number of births greater than the number of deaths) that approaches the upper end of the carrying capacity of the habitat, or 90-100 swift fox in the area. The Badlands National Park area, including the Buffalo Gap National Grasslands, supports one of the largest black-tailed prairie dog complexes in the state at approximately 19,000 acres of active colonies. Density estimates of black-tailed prairie dogs for 2002 in Badlands National Park was 19.4 prairie dogs per acre (unpublished data). This would create a rough estimate of 368,000 prairie dogs in the area. The Buffalo Gap National Grasslands and Badlands National Park currently support a wild population of black-footed ferrets of approximately 220 individuals (unpublished data). There is no known documentation of swift fox predations on black-footed ferrets, but it is assumed that predations may occur. The small size of the swift fox may allow it access in to burrows used by black-footed ferrets for escape from larger known predators such as coyotes and raptors. However, this smaller size of the swift fox may give black-footed ferrets a better chance at a successful defense if/when attacked. Predator avoidance by any species is crucial for survival and sustainability of that population.

Conclusion: Reintroductions of swift fox would have beneficial long-term impacts on threatened swift-fox. The incidental direct predation of candidate black-tailed prairie dogs by reintroduced swift fox would have negligible long-term impacts based on the extent of the prairie dog population in the area. The potential direct predation by reintroduced swift fox may affect, but not likely to adversely affect endangered black-footed ferret or black-tailed prairie dog populations.

Cumulative Impacts: Although there may be some negligible long-term adverse impacts on black-footed ferrets by predation by reintroduced swift fox, implementation of this

alternative would have long-term, moderate beneficial impacts to threatened and endangered species on the whole.

5. Visitor Experience:

The impacts of Alternative C are the same as Alternative B for visitor experience.

Cumulative Impacts The cumulative impacts of Alternative C are the same as Alternative B for visitor experience.

I. Impact Matrix

Table 1 . Summary Matrix of Impacts of Alternatives

	Alternative A – No Action	Alternative B – Hard Release Methods	Alternative C – Combination of Release Methods
Wildlife Resources	*None*	*Short-term negligible: Long-term beneficial*	*Long-term beneficial*
Threatened & Endangered Species	*Long-term, minor negative*	*Long-term, moderate beneficial*	*Long-term, moderate beneficial*
Paleontological Resources	*None*	*Short-term negligible: Long-term negligible*	*Short-term negligible: Long-term negligible*
Visitor Experience	*Long-term, negligible minor negative*	*Long-term beneficial*	*Long-term beneficial*

J. Identification of the Preferred Alternative

Because *Alternative C* reintroduces a native species with the highest expected rate of survival, the *Reintroduction of swift fox with a combination of release methods* provides the best opportunity for success and is the preferred alternative.

K. Identification of the Environmentally Preferred Alternative

The environmentally preferred alternative is the alternative that will promote the national environmental policy expressed in NEPA. National Park Service policy (*Management Policies* 2001) requires that an Environmental Assessment identify the environmentally preferred alternative. Simply put, "this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural and natural resources " (NPS, 2001). In an effort to restore a native species to the grasslands ecosystem with the greatest chance for success, the environmentally preferred alternative is to *reintroduce swift fox with a combination of release methods*, or *Alternative C.*

L. Impairment

National Park Service policy (NPS, 2001*a*) requires that management decisions, such as those outlined in this Environmental Assessment, not impair park resources. Impairment is defined as "an impact that, in the professional judgement of the responsible NPS manager, would harm the integrity of park resources or values, including the

opportunities that otherwise would be present for the enjoyment of those resources or values." The negative impacts discussed in the impact analysis section are the unavoidable result of reintroducing a native wildlife species that is necessary to preserve or restore the integrity of the park's prairie resources and the habitat value it provides. The negative impacts are mostly short-term, localized, and moderate or less in intensity. No resources would experience irreparable harm such that their function would be diminished. Consequently, it is determined that implementation of any of the alternatives considered in this Environmental Assessment would not constitute an impairment to wildlife, paleontological resources, threatened and endangered species, visitor use, or cultural resources.

VI. CONSULTATION AND COORDINATION

Public Review and Comment

In preparation for the development of this document, Badlands National Park initiated public scoping through a press release on November 7th, 2002 requesting comments and concerns from the public. A total of five written comments were received by December 1, 2002. An Open House was announced and held at the park headquarters in Interior, SD on January 16th, 2003 with an attendance of twenty-four individuals. Additional public meetings will be held in Wall, SD and Interior, SD on June 18, 2003.

The following agencies were contacted and/or consulted during preparation of this EA:

U.S. Fish and Wildlife Service (USFWS).

The National Park Service (NPS) conducted informal consultation with the Ecological Services Department of the USFWS in Pierre, South Dakota on endangered and threatened species issues on 13 November 2001. A copy of this EA was sent to the USFWS in June of 2003 requesting concurrence.

South Dakota Department of Game, Fish and Parks (SDGFP)

The NPS contacted SDGFP on threatened and endangered species issues of concern to the state on 30 October 2002. The NPS also requested a permit from the state to import wildlife. On 31 Mar 2003 the state issued the permit.

South Dakota Animal Industry Board (SDAIB)

The NPS contacted the SDAIB on 1 October 2002 to request support for swift fox recovery in the state. The SDAIB conducted a public hearing on this matter on 23 December 2002. Another public hearing is scheduled for July 2003 to address this EA..

South Dakota Department of Agriculture (SDDA)

The NPS contacted the SDDA on 6 November 2002 to request a permit for the import of swift fox from out of state. Pending.

South Dakota State Historic Preservation Officer (SD-SHPO)

The NPS contacted the SD-SHPO on 18 November 2002 to begin Section 106 compliance associated with proposed swift fox releases. A letter of determination was received January 16, 2003 concurring with "No Adverse Effect" for undertaking this proposed action.

Wyoming Department of Game and Fish, Wildlife Division (WDGF)
The NPS contacted the WDGF on 25 November 2002 to inquire about the potential of capturing wild swift fox from Wyoming and acquiring the necessary permits. Pending.

Colorado Division of Wildlife (CDW)
The NPS contacted the CDW on 4 November 2002 to inquire about the potential of capturing wild swift fox from Colorado and acquiring the necessary permits. A permit request was sent to CDW on May 5, 2003. Pending.

Turner Endangered Species Fund (TESF)
The NPS began informal discussions with representatives of TESF on January 23, 2001 about potential cooperation for swift fox recovery in South Dakota. A general agreement between TESF and NPS was initiated and written in March of 2003 and sent to the National Park Service Midwest Regional Office in Omaha, NE for review. Pending

U.S. Forest Service, Buffalo Gap National Grasslands (USFS)
The NPS began informal communications with the USFS in 2001 about potential cooperation on swift fox recovery in South Dakota. A general agreement between the two agencies was signed in 2003 outlining support and cooperation for swift fox recovery. Pending

U.S.G.S. Northern Prairie Wildlife Research Center (NPWRC)
The NPS began informal communications with the NPWRC in January 2001. A cooperative funding proposal was written for an experimental reintroduction of swift fox in Badlands National Park and was funded on 30 August 2002. Allocation of project funds and finalization of an interagency agreement are pending.

South Dakota State University (SDSU)
The NPS began informal communications with SDSU in October 2001 concerning potential cooperation and research associated with potential swift fox release. Through the SDSU Cooperative Ecosystem Studies Unit agreement with the U.S. Department of Interior, a graduate master's program was developed for January 2003 on experimental reintroduction of swift fox in Badlands. Initial research was completed on the project from January – April 2003.

National Swift Fox Conservation Team
The NPS began informal communications with the Swift Fox Conservation Team in January 2001 concerning interest in potential swift fox releases. The Swift Fox Conservation Team gave written support of swift fox reintroductions in Badlands National Park in their 2001 Annual report.

Oglala Sioux Parks and Recreation Authority, Pine Ridge Sioux Reservation
The NPS contacted the OSPRA on 9 December 2002 to begin communications on swift fox releases in Badlands National Park. Pending

Consultation and coordination are ongoing for this project. Prior to implementation of the proposed swift fox reintroductions described in the EA, all permits and necessary consultation will be in place.

VII. PREPARERS

Badlands National Park

Doug Albertson, Wildlife Biologist
Rachel Benton, Paleontologist
Eddie Childers, Wildlife Biologist
Sandee Dingman, Resource Management Specialist
Marianne Mills, Chief of Resource Education

VIII. REFERENCES CITED

Badlands National Park. 2001. Protocol for fecal line transect surveys to estimate predator relative densities in Badlands National Park. G.M. Schroeder, ed. Badlands National Park, Interior, SD 57750. 6 pp.

Badlands National Park. 2000. Coyote capture and immobilization protocol. G.M. Schroeder and D.D. Albertson, eds. Badlands National Park, Interior, SD 57750. 12 pp.

Bailey, V. 1926. A biological survey of North Dakota. North American Fauna 49:1-226.Bunker, C.D. 1940. The kit fox. Science 92:35-36.

Benton, R.C., 1998, Paleontological Inventory and Monitoring along the Loop Road, Badlands National Park, South Dakota, Report on File, Badlands National Park.

Biggins, D.E., J.L. Godbey, L.R. Hanebury, B. Luce, P.E. Marinari, M.R. Matchett and A. Vargis. 1998. The effects of rearing methods on survival of reintroduced black-footed ferrets. Journal of Wildlife Management 62(2):643-653.

Carbyn, L. 1998. COSEWIC status report on the swift fox. Committee on the status of endangered wildlife in Canada. Canadian Wildlife Service, Ottawa, Canada.

Carbyn, L., H.J. Armbuster, and C. Mamo. 1994. The swift fox reintroduction program in Canada from 1983 to 1992. In M.L. Bowles and C.J. Whelan. Restoration of endangered species: conceptual issues, planning and implementation. Cambridge University Press.

Cicimurri, D. 1995, A Survey of the Late Cretaceous Pierre Shale Formation exposed in Badlands National Park, South Dakota, Report on File at Badlands National Park

Clark, J., J.R. Beerbower, and K.K. Kietzke, 1967, Oligocene Sedimentation, Stratigraphy, Paleoecology and Paleoclimatology in the Big Badlands of South Dakota, Field and Geology Memoirs, Vol. 5, Field Museum of Natural History, 158 pp.

Dateo, D.M., J.A. Jenks, E. Dowd-Stukel, and C.S. DePerno. 1996. Survey of swift fox on Pine Ridge Ogalala Sioux Indian Reservation, Shannon County, South Dakota. Pages 69-75 in B. Luce and F. Lindzey, editors. Annual Report of the swift fox conservation team.

Egoscue, H. J. 1979. Vulpes velox. Mammalian Species 122:1-5. FaunaWest Wildlife Consultants. 1991. An ecological and taxonomic review of the swift fox with special reference to Montana. Boulder, MT. 49 pp.

Giddings, B. 1998. Swift fox management activities in Montana. Pages 18-22 in C. Roy, editor. Annual report of the Swift fox Conservation Team 1998. Kansas Department of Wildlife and Parks, Emporia, Kansas, USA.

Gries, J.P., 1996, Roadside Geology of South Dakota. Mountain Press Publishing Company, Missoula, MT, 358 pp.

Hall, E.R. 1981. The mammals of North America. Volume 2, pages 601-1181-90. John Wiley and Sons, Inc. New York, New York, USA.

Hall, E.R. and K.R. Kelson. 1959. The mammals of North America. Vol. 2, pages 547-1083. Ronald Press Co., NY.

Higgins, K.F., E. Dowd Stukel, J.M. Goulet, and D. C. Backlund. 2002. Wild mammals of South Dakota. South Dakota Department of Game, Fish and Parks. Pierre, SD. 278 pp.

Hillman C.N. and J.C. Sharps. 1978. Return of swift fox to northern great plains. Proc. South Dakota Acad. Sci. 57:154-162.

Johnson, D.R. 1969. Returns of the American Fur Company. 1835-1839. Journal of Mammalogy 50:836-839.

Kilgore, D.L. 1969. An ecological study of the swift fox in the Oklahoma panhandle. American Midland Naturalist 81: 512-534.

Knowlton, F. F. 1984. Feasibility of assessing coyote abundance on small areas. Unpubl. Rpt. Of Work Unit 909:01. Denver Wildlife Research Center, Denver, Colorado, USA.

Kruse, K.W., J.A. Jenks, and E. Dowd-Stukel. 1995. Presence of swift fox in southwestern South Dakota. Pages 91-99 in S.H. Allen, J.W. Hoagland, and E. Dowd-Stukel, editors. Annual Report of the swift fox conservation team.

Kunkel, K., K. Honness, M. Phillips, and L. Carbyn. 2001. Feasibility of restoring swift fox to west-central South Dakota. Turner Endangered Species Fund. Bozeman, MT. 38 pp.

Lala, H. 1996, Survey of Paleontological Resources of the Scenic Member of the North and South Units of Badlands National Park, Emphasizing Vertebrate Microfauna, Report housed in BADL Museum Collections Accession File 339.

Licht, D. 2000. Swift fox status on National Park Service lands. Pages 84-85 in C.G. Schmitt and B. Oakleaf editors. Swift Fox Conservation Team Annual Report. 2000.

Management Policies. 2001. U.S. Department of Interior. *National Park Service Management Polices 2001.* NPS D1416. 137 pp.

Martin J. and J. DiBenedetto 1998, 1997, Continuing Investigation of the Stratigraphy, Fauna and Taphonomy of the Brian Maebius Site, Tyree Basin, Badlands National Park, Report on File at Badlands National Park.

Martin J. and T. McConnell 1998, Documentation of Late Oligocene Fossils from Badlands National Park, South Dakota, Report on File at Badlands National Park.

National Park Service. 2001. Director's Order and Reference Manual #12: Conservation Planning, Environmental Impact Analysis, and Decision-making. U.S. Department of Interior. 91 pp.

Rand, A.L. 1948. Mammals of the eastern Rockies and western plains of Canada. National Museum of Canada Bulletin 108:1-237.

Robinson, W.B. 1953. Population trends of predators and fur animals in 1080 station areas. Journal of Mammalogy 76:723-729.

Samuel, D.E. and B.B. Nelson. 1982. Foxes. Pages 475-490 in J.A. Chapman and G.A. Feldhammer, eds. Wild mammals of North America: Biology, Management, and Economics. John Hopkins Univ. Press, Baltimore, Maryland, USA. 1147 pp.

Scott-Brown, J.M., S Herrero, and J. Reynolds. 1987. Swift fox. Pages 432-441 in M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ontario Trappers Assoc., North Bay. Ontario, Canada.

Soper, J.D. 1964. The mammals of Alberta. The Hamley Press Ltd. Edmonton, Alberta, Canada.

Sovada, M. A., C.C. Roy, and D. J. Telesco. 2001. Seasonal food habits of swift foxes in cropland and rangeland habitats in western Kansas. American Midland Naturalist 145:101-111.

Sovada, M. A., and B. K. Scheick. 1999. Preliminary report to the swift fox conservation team: historic and recent distribution of swift foxes in North America. Pages 80-147 + appendix in C. G. Schmitt, editor. 1999 Annual report of the Swift Fox Conservation Team. New Mexico Department of Game and Fish, Albuquerque, New Mexico, USA.

Stoddart, L.C., R.E. Griffiths, and F.F. Knowlton. 2001. Coyote responses to changing jackrabbit abundance affect sheep predation. Journal of Range Management 54: 15-20.

Swift Fox Conservation Team Annual Report. 2000. C.G. Schmitt and B. Oakleaf editors. 2001. New Mexico Department of Game and Fish, Albuquerque, New Mexico, USA.

Terry, D.O., and J. I. Spence, 1995, Documenting the Extent and Depositional Environment of the Chadron Formation in the South Unit of Badlands National Park, Report on File, Badlands National Park.

U.S. Forest Service. 2001. Land and Resource Management Plan-2001 Revision.United States Dept. of Agriculture, Forest Service, Rocky Mountain Region.

Uresk, D. W., and J. C. Sharps. 1981. Denning habitat and diet of the swift fox in western South Dakota. Great Basin Naturalist 46:249-253.

Vargas, A. and S.H. Anderson. 1999. Effects of experience and cage enrichment on predatory skills of black-footed ferrets (*Mustela nigripes*). Journal of Mammalogy 80(1): 263-269.

Von Loh, J., D. Cogan, D. Faber-Langendoen, D. Crawford, and M.J. Pucherelli. 1999. USGS-NPS Vegetation Mapping Program for Badlands National Park, South Dakota. USDI Bureau of Reclamation, Technical Service Center: Denver, Colorado.

Young, S.P. 1944. Their history, life habits, economic status, and control. Part 1. Pages 1-386 in The wolves of North America. The American Wildlife Institute, Washington, DC.

Zumbaugh, D. M., and J. R. Choate. 1985. Historical biogeography of foxes in Kansas. Transactions of the Kansas Academy of Science 88:1-13.